

Remarks on the classification of the genera
Hypena Schrank, 1802, *Dichromia* Guenée, 1854
and *Harita* Moore, 1882 (Lepidoptera : Noctuidae)

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Summary

The classification of the genera *Hypena* Schrank, 1802, *Dichromia* Guenée, 1854 and *Harita* Moore, 1882 is discussed. In order to characterise these genera, external and internal morphological characters of the adults of fifty-nine species, including many from the Old World tropics, have been studied. A character matrix for these genera, based on features of the male genitalia is presented. Differences are graphically shown as histo- and scattergrams. The genus *Dichromia* is re-established and notes on evolutionary strategies in this genus given.

Zusammenfassung

Die vorliegende Arbeit präsentiert einige grundsätzliche Gedanken zur Klassifikation der Gattungen *Hypena* Schrank, 1802, *Dichromia* Guenée, 1854 und *Harita* Moore, 1882. Grundlage sind morphologische Studien an Imagines, vor allem der männlichen Genitalarmaturen. 59 Arten des genannten Gattungskomplexes unter besonderer Berücksichtigung der altweltlichen Tropen wurden untersucht. Die Gattung *Dichromia* wird wieder eingeführt. Evolutive Tendenzen innerhalb der Gattung *Dichromia* werden kurz beleuchtet. Eine Merkmals-Matrix für die männlichen Genitalien, sowie graphische Darstellungen illustrieren die Resultate.

Résumé

Quelques réflexions fondamentales sur la classification des genres *Hypena* Schrank, 1802, *Dichromia* Guenée, 1854 et *Harita* Moore, 1882. Elles se fondent sur l'étude morphologique des imagos, en particulier des armatures génitales. Ont ainsi été examinées 59 espèces de ce groupe de genres, plus particulièrement des genres des régions tropicales de l'Ancien Monde. Le genre *Dichromia* est rétabli, avec quelques remarques sur les stratégies évolutives dans ce genre. L'auteur présente une matrice des caractères des genitalia mâles, ainsi que des graphiques pour illustrer ses résultats.

Introduction

The genus *Hypena* Schrank, 1802 is without doubt a “mega-genus” with a world-wide distribution. The major groups of species are found in tropical regions. The genus-complex *Hypena* s.l. is in need of a reclassification on a global basis. In the past, our understanding of the phylogenetic relationships was biased by a somewhat egocentric point of view of European lepidopterists. From our current knowledge of systematics, it is clear that classifications, especially of huge groups like the noctuids, cannot be based exclusively on a study of European material (or of any other single region). It is not far from reality to state that previous classifications were more likely a mirror-image of the “geographical distribution pattern” of the entomologists than of the evolutionary coherences.

In order to clarify the situation regarding the genus *Hypena* s.l., external and internal morphological characters of 59 species were studied. Species from the Old World tropics, Australia and the Palaearctic Region have been taken into consideration.

List of species studied

Hypena Schrank, 1802

- abyssinalis* Guenée, 1854
albizona Fletcher, 1961
albirhomboidea Prout, 1921
brevicella Prout, 1928
chionosticha Fletcher, 1961
crassalis (Fabricius, 1787)
cryptica Robinson, 1975
euthygramma Prout, 1921
fijiensis Robinson, 1975
fractilinealis Snellen, 1886
fuscularis Saalmüller, 1891
hoareae Holloway, 1977
iconicalis Walker, 1859
jussalis Walker, 1859
laceratalis Walker, 1859
leucosticta Bethune-Baker, 1909
lividalis (Hübner, 1790)
neoplyta Prout, 1925
obacerralis Walker, 1859
obesalis Treitschke, 1829
obsitalis (Hübner, 1813)
obsoleta Butler, 1877
ophiusinalis Mabille, 1879
palpalis (Hübner, 1796)
phricocyna Fletcher, 1961
plagiota (Meyrick, 1899)
porphyrophaes Fletcher, 1961
prionodes Fletcher, 1961
proboscidalis (Linnaeus, 1758)
puncticosta Prout, 1925
robustalis Snellen, 1880
rostralis (Linnaeus, 1758)
scabra (Fabricius, 1798)
scotina Fletcher, 1961
striolalis Aurivillius, 1910
tristalis Lederer, 1853
tristigma Holloway, 1976
varialis Walker, 1866
viridifascia Fletcher, 1963

Dichromia Guenée, 1854

- antimima* (Fletcher, 1961) **comb.n.**
cognata (Moore, 1885) **comb.n.**
erastrialis (Walker, 1866) **comb.n.**
leucotaenia (Snellen, 1880)
mutilata (Strand, 1909) **comb.n.**
nasuta (Mabille, 1884)
quadralis Walker, 1859
sagitta (Fabricius, 1775)

limbopunctata (Strand, 1915) **comb.n.** *tanis* (Swinhoe, 1917) **comb.n.**
mesomelaena (Hampson, 1902) **comb.n.** *thomensis* (Prout, 1927)
modesta (Moore, 1882) *trigonalis* Guenée, 1854
munitalis (Mann, 1861)

***Harita* Moore, 1882**

belinda (Butler, 1879) *nodyna* (Bethune-Baker, 1908)
brachyphylla (Turner, 1903) sp. (from Fiji)
nebulosa (Moore, 1881)

Note : *Harita rectilinea* Moore, 1882, the type species of the genus has not yet been investigated, as the abdomen of the type specimen in MNHU, Berlin, is missing.

Structural characters of the male genitalia of *Hypena* s.l.

At a first glance, the male genitalia of the three genera do not exhibit striking morphological features (Fig. 1). They are bilaterally symmetrical. The shape of valves, uncus and vinculum is rather uniform (except in some specialised *Hypena* s.str. species, e.g. *Hypena paliscia* (Bethune-Baker, 1911), which has strongly modified valves (Lödl, 1993a)). The genitalia are not heavily sclerotised.

The relative size of the genitalia is of considerable importance. In "true" *Hypena*, the size of the genitalia is, compared to the size of the adult, extraordinarily small. The genitalia of *Dichromia* and *Harita* are proportionately considerably larger. The proportion of genitalia size to wingspan is significantly different in the three genera and one of the constitutive features (Fig. 3). The uncus is hook-shaped and sclerotised. The tegumen has sclerotised and granulated areas around its caudal margin ventrolaterad of the articulation with the uncus. The diaphragma (fultura) is ventrally bloated with scaphial and subscaphial sclerotisations around the tuba analis and granulations and tiny spines can be found. The valves are always rounded, not heavily sclerotised. There is a noteworthy tendency of *Hypena* s.l. genitalia to resist proper cleaning in the preparation process. *Hypena* genitalia are found to be difficult to prepare due to the flabby consistence and inconvenient, oily appearance of the valves, which presumably could be noted as a sort of "physiological synapomorphy".

In some species groups a clasper is present and the valves occasionally have processes on the cucullus and sacculus. Some species exhibit a marked tendency to extend the sacculus (e.g. in *Dichromia*, where the ventro-proximal extension is a constitutive feature). A clavus is present and the juxta is well developed.

The aedeagus is rather small, the most striking synapomorphic feature is the cuff in the medial part of the aedeagus corpus, most prominent in the dorsodistal part of the aedeagus (carina area). This spiny tissue

seems to have its origin partly in the anellus where the aedeagus is inserted. The vesica is difficult to evert and bears several thorns, spines and bundles of cornuti. Typical for *Hypena* and *Dichromia* is the "shark-toothed" appearance of cornuti at the distal end of the aedeagus when the vesica is not everted. A feature which is not found in the genus *Harita*.

Analysis of the male genitalic characters distinguishing *Hypena*, *Dichromia* and *Harita*

The following genital indices are of great importance at the generic and specific levels :

- [i] length of valve vs. height of genitalia corpus (vl : h)
- [ii] length of valve vs. breadth of valve (vl : vb)
- [iii] length of uncus (ul) vs. proportions of valves
- [iv] length of aedeagus (ael) vs. proportions of genitalia corpus.

List of abbreviations :

- ael length of aedeagus
- h height of genitalia corpus (saccus to uncus-articulation)
- vb breadth of valve
- vl length of valve
- wsp wingspan

The height of the corpus is measured from the end of the saccus to the articulation of the uncus. Due to distortion effects, the measurement of the flabby parts of the tegumen area (especially the breadth of the genitalia corpus) appear to be anything else than fruitful. The aedeagus bears numerous features which seem to be significant at the species level. Besides the length, the angle of the "boomerang"-shaped aedeagus is of considerable importance.

Typical male genitalia of *Hypena*, *Dichromia* and *Harita* are illustrated in Fig. 1. The arrows mark features of diagnostic importance. A character matrix is given in Table 1. Statistically significant differences between *Hypena* and *Dichromia* can be demonstrated for the proportion of the valve length to wingspan. The number of *Harita* individuals investigated so far is too small to allow conclusive remarks and a statistical evaluation is not possible.

The frequency of genital index vl : h values for *Hypena* and *Dichromia* (Fig. 2) clearly demonstrates the distinction between the two genera. The mean vl : h value for *Hypena* is 0.84 ± 0.04 (standard deviation) and for *Dichromia* 1.04 ± 0.03 . The 59 *Hypena* samples are taken from

Table 1
Character matrix comparing the genera *Hypena*, *Dichromia* and *Harita*
based on the male genitalia

Feature	<i>Hypena</i>	<i>Dichromia</i>	<i>Harita</i>
Uncus	short, hook prominent, broadest part mainly in middle of uncus	slim appearance, hook moderate, not broadened in medial part	remarkably slim, sickle-shaped, not broadened in medial part, knob-like articulation
Analtube	very prominent, sometimes longer than uncus, scaphial and subscaphial sclerotisations below 2 mm	prominent, sclerotisations present	not so prominent as in previous taxa
Size of genitalia valves	small, inconspicuously rounded or with process of sacculus, bunches of scales, process of cucullus commonly present, medio-dorsal margin convex	At least 2 mm, usually greater very large, rounded ("elephant-ears"). Sacculus significantly extended ventro-proximal with granulated area; medio-dorsal margin concave	above 2 mm large, rounded, conspicuously slim, no processes; dorsal margin more or less straight
vl : h aedeagus	0.75-0.95 cuff very prominent "shark-teeth" primary position of cornuti	1.02-1.11 cuff very prominent "shark-teeth" primary position of cornuti	0.95-1.02 cuff present, short and compact, no "shark-teeth"
ael : h	mainly between 60-90%	mainly between 60-90%	mainly around 30%
vl : wsp	under 6% (mean 4.4%)	above 6% (mean 8.9%)	above 11% (one species checked)

39 different species from all continents. The 18 *Dichromia* samples are from 15 different species. The separation of *Hypena* and *Dichromia* can be further demonstrated by comparing valve length with wingspan (Fig. 3).

In order to give an idea as to the position of *Harita* in relation to *Hypena* and *Dichromia* the range of the relationship of vl : vb to vl : h is indicated in Fig. 4. The larger range of *Hypena* reflects the remarkable variation in valve proportions in that genus.

Remarks regarding the classification of the genus complex *Hypena* s.l. and the re-establishment of the genus *Dichromia*

At present, the genus *Hypena* s.l. (including *Dichromia*) contains an estimated 680 described taxa. About 500 (presumably slightly less) are

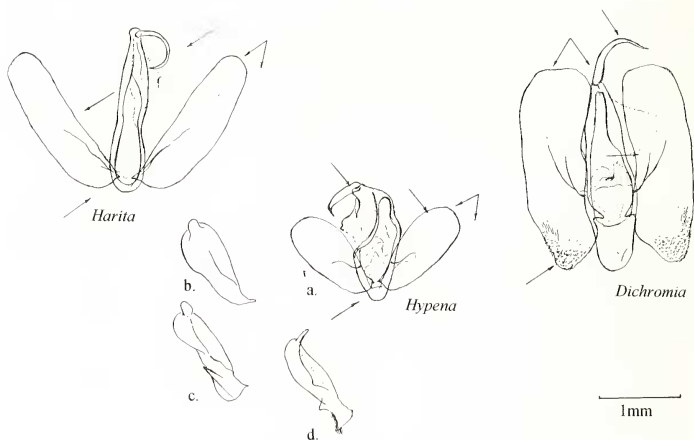


Fig. 1. Typical male genitalia of *Hypena*, *Dichromia* and *Harita*. The arrows indicate features of diagnostic importance. The species are : *Harita nodyna* (Bethune-Baker, 1908) (Ekeikei, New Guinea) ; *Hypena* species : a) *H. obsitalis* (Hübner, 1813) (Haifa, Palestine), b) *H. prionodes* Fletcher, 1961 (Ruwenzori, Uganda), c) *H. jussalis* Walker, 1859 (= *H. strigatus* auctt.) (Mt. Mlanje, Nyasaland), d) *H. puncticosta* Prout, 1925 (Durban, Natal) ; *Dichromia erastrialis* (Walker, [1866]) (Natal).

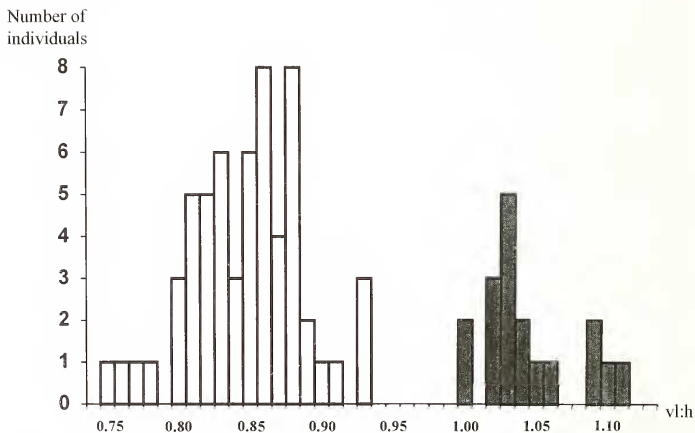


Fig. 2. Differences between the genera *Hypena* (open bars) and *Dichromia* (filled bars). Histogram of the frequency of valve length : height of genital corpus values.

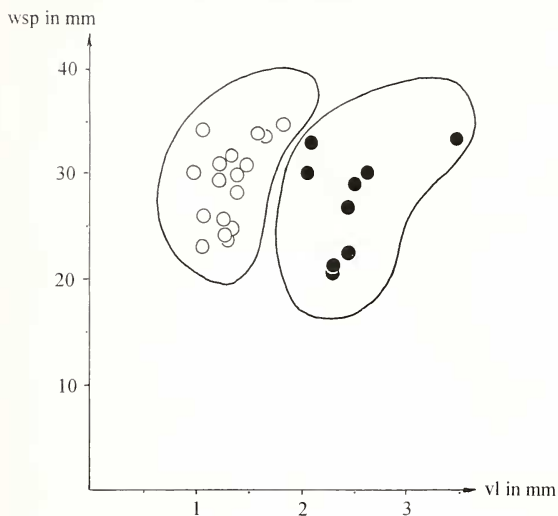


Fig. 3. Differences between the genera *Hypena* (open circles) and *Dichromia* (closed circles). Genital size (characterised by valve length) plotted against size of imagines (characterised by wingspan).

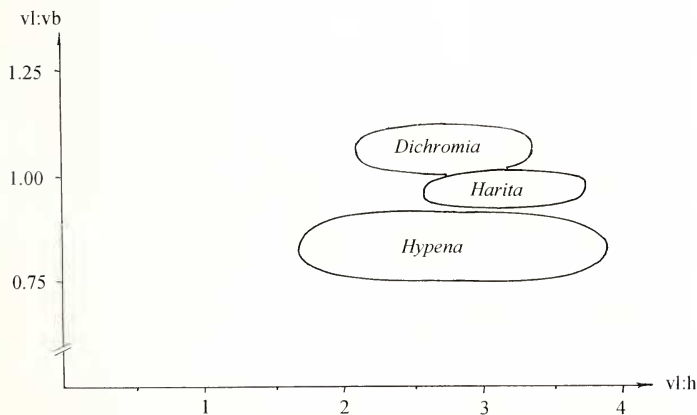


Fig. 4. The genital index valve length : breadth plotted against valve length : height of genital corpus — range of values for the genera *Dichromia*, *Harita* and *Hypena*.

valid species. The genus *Harita* is very small, consisting of less than 10 taxa. Without doubt, the genus *Hypena* is one of the richest genera within the Lepidoptera with regard to the number of species and clearly occupies one of the top places in the hollow curve. Within the noctuids the genus *Hypena* is second after the genus *Euxoa* Hübner, [1821] with an estimated 700-800 taxa. *Hypena* is followed by *Agrotis* Ochsenheimer, 1816 (approximately 600 taxa) and *Catocala* Schrank, 1802 (approximately 500 taxa) (Poole, 1989).

The genus group *Hypena* (comprising at least *Hypena*, *Trichypena* Joannis, 1915, *Dichromia* and *Harita*) is here recognised as a monophyletic unit. The systematic position of the genus *Anoratha* Moore, 1867, with 5 species, is obscure at present (Lödl, 1993a), as also is the position of *Ctenypena* Prout, 1927. Structural characters of the male copulatory system are of great importance.

Though the genus *Hypena* s.str. tends to vary quite widely around the unified genitalia pattern, e.g. *Hypena paliscia* (Bethune-Baker, 1911) and allied species (Lödl, 1993a), the constitutive features are obvious (aedeagus cuff, hook-shaped uncus, unified ground plan of the wing pattern (Lödl, 1993b), elongated and obliquely porrect palps). *Hypena* also exhibits a remarkable tendency for habitual modifications, but which, at a closer look, cannot mask its monophyletic origin. The genus *Hypena* s.str. is a huge, but well defined group. Based on our present knowledge the author would reject a concept of splitting *Hypena* at the generic level. An arrangement into species-groups (probably subgenera) seems to be advisable.

The genus *Ophiuche* was described by Hübner, [1825] on the basis of his well known species *lividalis* Hübner, 1790. It is generally accepted as a synonym of *Hypena*. The author agrees with this usage for the moment. Although *lividalis*, due to its specific genitalic characters, doubtlessly belongs to the *Hypena* complex there is a remarkable independence regarding the highly modified ground plan of wing pattern and wing coloration. The head and genitalia proportions are typical for *Hypena*; in contrast, a granular area of the sacculus and a distinct process of the cucullus impede a correct placement of this taxon. The features of this uniform species need to be investigated in detail. The known distinct characters clearly do not justify the resurrection of the genus *Ophiuche*.

Previously published papers used the taxon *Dichromia* exclusively for species with yellow hindwings (Warren in Seitz, 1913). The best example is the type-species *Dichromia orosia* (Cramer, 1780) (a junior synonym of *Dichromia sagitta* (Fabricius, 1775)). Due to the obvious similarity

to species of the genus *Hypena* and despite deficient knowledge of the genitalia structure, *Dichromia* was recently synonymised with *Hypena* (Inoue *et al.*, 1982 ; Poole, 1989).

In the male genitalia, *Dichromia* exhibits some synapomorphies (e.g. ventro-proximal sacculus extension) which forces its re-establishment at the generic level. *Dichromia* is the sister genus to *Hypena* and shows a remarkable constancy of its genitalic characters. The reasonable number of some dozens of species, coupled with the constancy of structural differences, fully justifies the splitting on the basis of the "rule of generic relation" (Mayr, 1975).

Evolutionary tendencies

At the present stage, it is difficult to give a reliable survey of evolutionary strategies within the genus *Hypena* s.str. Members of the genus realise different modes of a ground plan. Decisions as to whether particular characters are plesiomorphic or apomorphic must be treated with caution. However, some tendencies are obvious : Complex modifications of the processes of the sacculus are found in Old World species, namely *Hypena laceratalis* Walker, 1859, *Hypena albizona* Fletcher, 1961, *Hypena puncticosta* Prout, 1921, *Hypena bonaberi* Strand, 1915 and *Hypena paliscia*. It would be an interesting exercise to try to demonstrate a link between the distributions of these African species and African centres of diversity.

Much work remains to be done too within the species groups which are confined to high and very high altitudes. They appear to exhibit a marked tendency to reduce the stability of their wings. These species, which could be called "weak-wings" (e.g. *Hypena albirhomboides* Prout, 1921), have slender bodies, small heads and very small male copulatory organs without any processes. The valves are simply rounded and are very poorly sclerotised. These observations need to be consolidated by examining a larger number of individuals and comparing similar forms from the East African mountainous regions and the Himalayas.

The generic separation of *Trichypena* has not yet been convincingly demonstrated. It could well be the most striking end of the branch of stoutly bodied, round-winged forms with broad heads and large eyes.

The genus *Dichromia* expresses different evolutionary trends. Besides the classic examples with "Hypena-like" forewings and yellow hindwings, we find species with a cuneiform eclipse in the central symmetry system

of the forewing and "normal" brown hindwings. The first is a typical Asian species group, reaching its north-western border in the south-east of Europe (*Dichromia munitalis* (Mann, 1861)). Finally, we find species in the Old World tropics with generally darkened (even black) forewings with white bands. These species represent an evolutionary branch with very large male genitalia and extraordinary huge "elephant-ear"-shaped valves.

The synonymy of the genera discussed above is briefly outlined in Lödl, 1993c.

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